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Handshape contrasts in sign language phonology

Diane Brentari and Petra Eccarius

1 Introduction

Of the five parameters of sign language structure – handshape, movement, place of articulation, orientation and nonmanual behaviors – handshape is the parameter that has been analyzed most successfully with a variety of methodologies, both theoretical and experimental. Since it is here that we find the most complete body of work to draw upon, we have chosen to examine handshape behavior as a way of better understanding the nature of phonological contrast in signed languages.¹ The goal of this chapter is twofold. First we will draw attention to the range of variation in the form and use of handshapes, and second, we will analyze the distribution of handshape properties. We will also investigate these issues both crosslinguistically and language-internally in order to determine which features are phonologically contrastive and where they are contrastive in the lexicon.

In order to achieve our goal of showing how sign languages use handshape in their phonological systems, a little background is necessary on both the organization of a sign language lexicon and the phonological structure of signed languages. After covering this introductory material and our methodology in sections 1 and 2, we will describe differences in the way that handshape feature classes are used across the three components of the lexicon (foreign, core and spatial) in three different sign languages – namely, American Sign Language (ASL), Swiss German Sign Language (DSGS) and Hong Kong Sign Language (HKSL). In sections 3–5, we analyze specific distributions of two types of handshape properties – *selected fingers* and *joint configuration* – across the lexicon and across different classifiers types. Evidence will be presented showing (1) that both selected finger combinations and joint configurations can behave differently across the lexicon, and (2) that even among different types of classifier handshapes, there are systematic distributional differences regarding these properties, due in part to the link between morphology and iconicity. In section 6, we address the theoretical consequences of our results. We begin the section by discussing recent work in

phonological theory (Clements 2001), demonstrating that the two most commonly held categories of phonological distribution (*distinctive* and *allophonic*) are not sufficient to represent the types of feature contrasts found in spoken or sign language data.

1.1 Handshape in a sign language lexicon

Many languages of the world – signed and spoken – have lexicons composed of words with different origins. Itô and Mester (1995a, 1995b) propose a core-periphery model for Japanese that not only captures these different origins (Yamoto, Mimetic, Sino-Japanese and Foreign) but also presents an analysis of the differences in sound and constraint distribution. One example from Japanese used by Itô and Mester to illustrate their point is the distribution of [h] and [f], shown in (1). In the *core* (which includes the Yamoto, Sino-Japanese and Mimetic components), [h] and [f] are allophones of /h/, while in the *periphery* (Foreign component), /h/ and /f/ are phonemic. This is illustrated by the fact that in the core [f] does not appear before any vowels except [u] (i.e., *[fa], *[fe], *[fi], *[fo]), where [h] appears instead; in other words, they are in complementary distribution. In the periphery, however, both [h] and [f] appear more or less everywhere, showing that these two sounds – or, more specifically, these two opposing values of the feature [labial] – are distinctive in the periphery.²

- (1) Distribution of [h] and [f] in Japanese:
- a. core distribution (Yamoto, Sino-Japanese and Mimetic components)

*[fa],	*[fe],	*[fi],	*[fo],	[fu]
[ha],	[he],	[hi],	[ho]	∅
 - b. foreign distribution (borrowings)

[fa],	[fe],	[fi],	[fo],	[fu]
[ha],	[he],	[hi],	[ho]	∅

Following Ito and Mester's model for the Japanese lexicon, Brentari and Padden (2001) proposed a three-part lexicon for ASL (see Figure 13.1). These three lexical components – core, foreign and spatial – behave differently not only because of their historical sources, but also with respect to morphological and phonological criteria in the synchronic grammar.

Figure 13.2 shows ASL examples from each component. While handshapes in all components are composed of sub-lexical structures and phonological features,

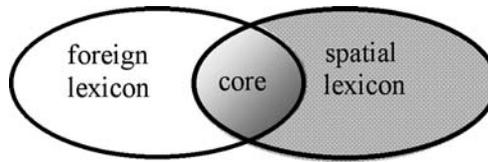


Figure 13.1 *The ASL lexicon (from Brentari & Padden 2001).*



Figure 13.2 *Examples of signs from the three lexical components. Top row (core): TEACH, STRANGE, BENEFIT; middle row (foreign): OPINION, CAFETERIA, GET-AN-F; bottom row (spatial): round-pipe, hold-binocular, hold-thread.*

their morphophonemic properties differ across the lexicon. In the core, handshapes are exclusively phonological and combine with other elements to form stems – i.e., both the handshape as a whole and the features from which it is composed *have no meaning*. Examples are TEACH, STRANGE and BENEFIT. The foreign component of the lexicon has forms that have a relationship with the surrounding spoken language or another sign language. The foreign forms that we will discuss in this chapter are the initialized forms, which have a handshape of the manual alphabet as an affix and are built from stems in the core. This means that, like the core, the handshape features have no meaning, but that, unlike the core, the handshape as a whole *has meaning*. Examples are OPINION, CAFETERIA and

GET AN 'F.' The spatial component includes spatial signs (UP, DOWN, etc.) and classifier constructions. Classifier constructions are polymorphemic complexes with a verbal root – the movement – and affixes that involve place of articulation and handshape. Therefore, in classifiers, either the whole handshape or its features *have meaning*, the latter often carrying information about the size and shape of the object. Examples are 'binoculars,' 'round-pipe,' 'hold-thread.' In addition, Benedicto and Brentari (2004) show that classifier handshapes also demonstrate syntactic alternations such as transitive and intransitive; the handshapes in the other two components do not carry this type of morphosyntactic information.

The core and spatial components are considered the native components of the lexicon, with foreign forms conforming to the native lexicon to varying degrees depending on their adherence to the constraints of the core. In general, as a form gets further from the core – either in the direction of classifier forms or in the foreign vocabulary – it obeys fewer of the set of phonological constraints attested in core forms. Furthermore, just as there is asymmetry in the distribution of the sounds [h] and [f] across the lexicon of spoken Japanese, we also see an asymmetry in the inventories of handshapes that occur in the three components of ASL. The examples in Figure 13.2 show the same three handshapes being used in each component (namely ,  and , but not all handshapes occur in all three components. Some examples of those that do not appear in all lexical components are given in Figure 13.3.

To summarize, handshapes and their features across the three components of the ASL lexicon have different types of phonological, morphological and sometimes syntactic relationships within different components of the grammar. In the core,

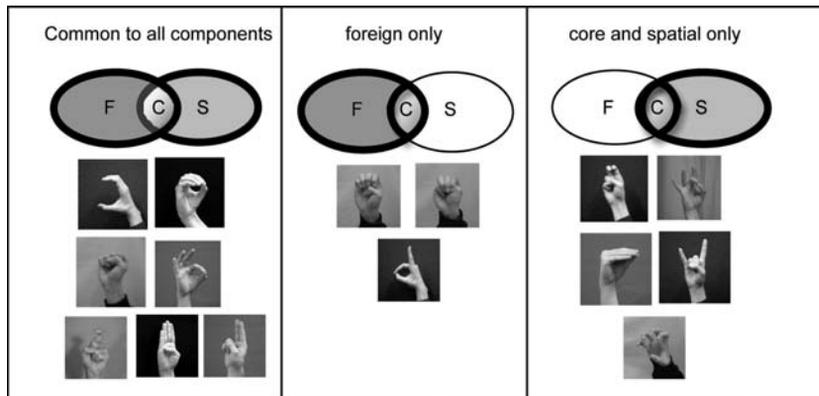


Figure 13.3 Handshape asymmetries across ASL lexical components.

handshapes have no morphological status. In the foreign lexicon, the whole handshape is an affix with its own meaning, playing a morphological role. Finally in the spatial component, handshape features can play both a morphological and a syntactic role. Although Brentari and Padden's model was developed to represent phonological behavior in ASL signs, here we apply it to the other two languages in this analysis as well, because all three languages also have the same types of lexical components.

1.2 The phonological structure of handshape

The structure of handshape is given in Figure 13.4; while there is reasonably wide consensus about the general structure of handshape among various models of sign language phonology, the one here is taken from Brentari 1998. The two main structures of handshape are the *joints* and the *selected fingers*; these are class nodes in the feature geometry. The joints structure expresses the disposition of the joints – [stacked], [spread], [flexed] (closed) or [crossed] – as well as which joints are affected by the feature – the base joints (knuckle joints) or the non-base joints (intrapalangeal joints). The selected fingers structure expresses which fingers are foregrounded in the handshape. Selected fingers typically move and/or make contact with another part of the body during the articulation of a sign (depending on orientation and other physical limitations). The number of these fingers is expressed by *quantity*, and their *point of reference* can be [ulnar] (pinkie/little-finger side) [mid] (part of the hand referencing the middle finger), or the unmarked “radial” (index-finger side). For example, ,  and  all have a [one] quantity specification but with different points of reference on the hand – [ulnar], [mid] and radial, respectively.

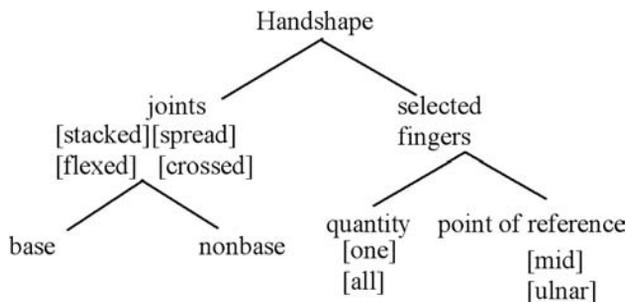


Figure 13.4 *The phonological structure of handshape (Brentari 1998).*

The handshape structure fits into the larger structure of the Articulator (which can include a second hand, the arm or the body as an articulator), and the Articulator, in turn, fits into the larger structure of the sign, including place of articulation and movement. Since none of the other structures are involved in the analysis presented here, the only one we introduce is that of handshape.

2 Methodology and description of the data

In order to describe and analyze handshape, we examined a variety of data from ASL, DSGS and HKSL. We chose these particular languages for two main reasons. First, we had access to many kinds of data in each language; phonological and/or morphological information on core and foreign forms was available to us via dictionaries and/or lexical databases (Stokoe, Casterline & Croneberg 1965, Boyes Braem 2001a, Valli 2005 and Tang 2007, among others), and classifier data was available because they are three of the languages in a larger crosslinguistic project focusing on classifier constructions. Second, we believe that these three languages are sufficiently different from each other historically to facilitate crosslinguistic comparison – HKSL shares no common linguistic ancestor with the other two languages, and ASL and DSGS are only very distantly related, if at all.

Core and foreign data were taken from the dictionaries and lexical databases mentioned above. In the case of HKSL and DSGS, information was checked with local researchers whenever possible. The classifier data used in this work are examples taken from a larger set, including signers' descriptions of 300 pictures and five short stories designed by Zwitserlood (2003). These stimuli depict a wide range of participants and events, both plausible and implausible, in hopes of eliciting both common and rare forms. (More detailed descriptions of specific stimulus items will be provided in later sections as necessary.) The dataset also included interviews with informants during which signers provided grammaticality judgments about how the articulation of classifiers could (and could not) be altered morphologically using a variety of fingers and joint configurations. For all classifier data, we used elicitations from three native signers per language.

Before presenting our analysis, a few points are worth mentioning. First, the results that we report here are qualitative. Since our data come from a wide range of sources, counting the number of tokens for any given handshape on any given task is much less relevant to our analysis than is a consistent pattern seen across all of the data we included. Second, for this work, the phenomena described consider only handshapes that do not change within a sign. We did this because we wanted to be consistent across all lexical components – since classifier and foreign handshapes

occur most often without a change, we held to the static set of handshapes across all components. Third, as we discuss the handshapes in the following sections, we refer mostly to the four fingers of the hand; the thumb is largely left out of the discussion because of its vast possibility for phonetic variation and its independence from the other fingers. Finally, since certain handshapes are ubiquitous throughout sign languages (for example, those with all of the fingers or only the index finger selected, and/or those with joint configurations that are fully open and fully closed), we chose three-finger handshapes for the selected fingers analysis and stacked joints for the analysis of joint configuration (described in detail below), both of which are much less common. Sections 3 to 5 are summaries of a more detailed analysis of these forms that appears in Eccarius (2008).

3 Selected finger combinations: distribution of three-finger handshapes

In this section, we describe the distribution of three-finger handshapes (3FHSs) for each language, both crosslinguistically and language-internally. These are handshapes in which three digits other than the thumb are selected. In terms of the representation in Figure 13.4, 3FHSs are captured by a dependency relation: one-finger handshapes have a [one] feature; four-finger handshapes have an [all] feature; two-finger handshapes have a dependency relation [one] > [all] and three-finger handshapes have a relation [all] > [one] (Brentari *et al.* 1996, Brentari 1998, van der Kooij 2002). Traditionally, these handshapes are considered to be marked across sign languages due to their rare occurrence crosslinguistically and language-internally, their physical complexity and their tendency to be acquired late (e.g., Battison 1978; Woodward 1985, 1987; Boyes Braem 1990a). Because of these facts, we expected that these handshapes would not be equally distributed across the lexical components of individual languages. In particular, we expected that 3FHSs would occur more often in the foreign and spatial components than in the core within languages since according to Ito and Mester's model, core forms adhere to more constraints and are thus more limited. We also predicted crosslinguistic differences regarding the specific phonological constraints motivating this tendency.

In addition to using dictionaries and lexical databases as sources for core and foreign forms in each language, articulatory interviews and a short story were used to elicit classifier handshapes. The short story contained a three-legged boy to see whether or not such a character would be represented by a 3FHS. (See Figure 13.5 for a sample image of the story from Zwitserlood 2003 and for example handshapes used by signers to express the three-legged person.)

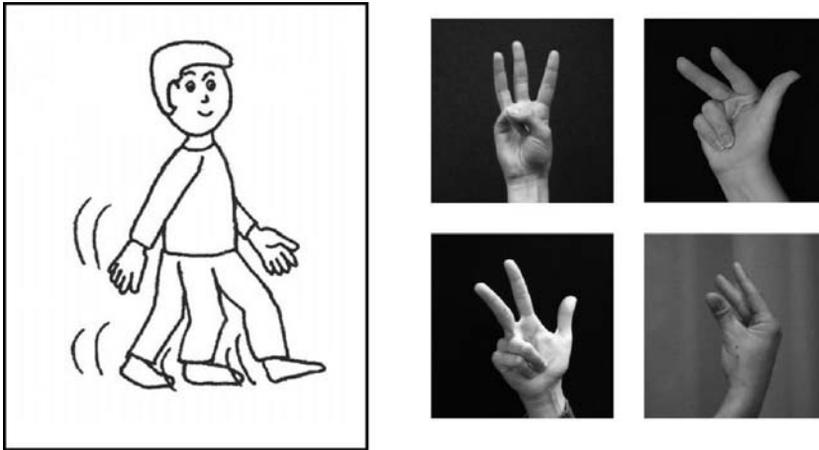


Figure 13.5 (left) Stimuli used to elicit 3FHSs. (right) Examples of 3FHSs.

The data indicate that there are crosslinguistic differences regarding the acceptability of 3FHSs in the various parts of the lexicon (Figure 13.6). Crosslinguistically, HKSL appears to be more accepting of 3FHSs in core signs than DSGS and ASL based on the available data. These handshapes are still marked in HKSL (based on frequency), but they do occur in at least a few core lexical signs. We also see a greater variety of 3FHSs as classifiers (i.e., variation in allowable joint configurations and in the specific fingers selected) in HKSL than in the other languages, as well as a higher degree of certainty about using them. Our data also indicate that within languages, the distribution of 3FHSs was not homogeneous; more (if not all) of these handshapes tend to be found in the foreign and classifier components of the lexicon rather than in the core. These language-internal facts are described in the next three subsections.

3.1 ASL

Examining the entries in the two ASL dictionaries (Stokoe, Casterline & Croneberg 1965 and Valli 2005), we found four 3FHSs in use within the core or foreign components – , ,  and . The first three, ,  and , are from the ASL fingerspelling alphabet and were used exclusively in initialized signs (e.g., WEDNESDAY, DORMITORY, MUSEUM). The fourth handshape, , was used in only one sign borrowed from a hearing gesture (BOY SCOUT). In other words, all signs in the ASL dictionaries using 3FHSs could be categorized as

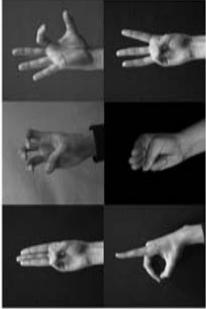
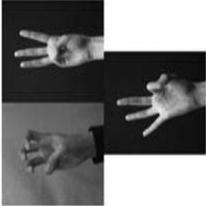
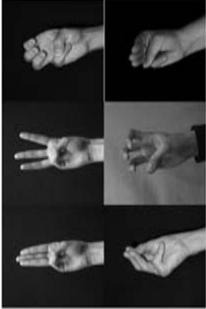
	FOREIGN	CORE	CLASSIFIERS
ASL			
DSGS			
HKSL			

Figure 13.6 Examples of three-finger handshapes (3FHSs) in the foreign, core and classifier components of ASL, DSGS and HKSL.

foreign; there were no signs found that could be classified as “core” by the criteria spelled out in Brentari and Padden 2001. In the ASL classifier data, 3FHSs were used, but to varying degrees depending on the informant. For depictions of the three-legged-boy, only one of the three informants used a  handshape spontaneously, and that was only after starting with a two-fingered handshape (i.e., the 3FHS was not her first instinct). The other two informants did not use  spontaneously but thought it would probably be acceptable (although one did not allow the handshape if movement was added). In the articulatory interviews, when asked about using  to depict the thickness of an object at a gradation between what was represented by two and four fingers (e.g., a medium-sized paintbrush), all of the ASL informants declared it to be ungrammatical. One signer did say that  and  could be used for tools (e.g., fork, three-pronged rake), but only if accompanied by an extensive description of the object, adding that it would be ungrammatical if such a handshape was *used* as a rake, as in an instrumental classifier.

3.2 DSGS

In the DSGS lexical databases, we found six 3FHSs: , , , ,  and .³ Again, all 3FHSs were from components outside the core; they were either initialized (e.g., WAADT [place name], DIGITAL, MATURA [a specific kind of test]), borrowed from other sign languages ( to  in WALES,  in WC/TOILETTE ‘toilet’), or (in one case) a classifier handshape in the process of lexicalization ( in NATEL ‘cell phone’; Boyes Braem, personal communication). As with ASL, there appeared to be no 3FHS in the core lexicon of DSGS. Also similar to ASL, use of these handshapes in the classifier data was infrequent and varied by informant. Two of the three informants used  spontaneously in their retelling of the three-legged-boy story; one used it spontaneously throughout but commented that it was a difficult handshape to produce, while the other used it to introduce the character but then proceeded to use two-finger handshapes (both classifier and lexical) to represent the boy in the rest of the story. The third DSGS informant did not use a 3FHS in the story at all, consistently using a handshape with two fingers and the thumb to represent the three-legged boy. When asked about the grammaticality of , she seemed uncertain and said she preferred the two-finger handshape. In response to interview questions about 3FHSs, the informants did not accept most three-fingered alterations of established classifiers (e.g., changing the thickness of an object, or representing three specific prongs of a fork), although one signer did offer a form changing from  to  to represent birds’ claws grabbing something.

3.3 HKSL

The HKSL dictionary yielded signs using five 3FHSs: , , ,  and .⁴ The origins of many of these signs is uncertain, but while some were outside the core – either character signs (i.e., foreign signs based on written characters, e.g.,  in ILLEGAL,  in JADE), borrowed signs (e.g.,  in WC) or signs still closely related to the classifier system (e.g.,  in FORK) – unlike in ASL and DSGS, there are also core lexical items with 3FHSs (e.g.,  in CHAMPION,  in CANCER,  in TRENDY).⁵ 3FHSs were also more prevalent in the HKSL classifier data than they were in the other two languages. In representing the three-legged boy, all informants used  spontaneously throughout the story. In response to interview questions about morphological alternations involving 3FHSs for thickness or size and shape, all informants allowed 3FHS in at least some situations, although answers varied regarding which classifiers could be modified using three-fingered versions (e.g., rope, paintbrush, cat’s paw) and with what joint configurations (e.g., extended, bent, crossed). Interestingly, HKSL also uses 3FHSs in their number system ( and  are both acceptable variants of ‘3’), while ASL and DSGS do not.⁶

4 **Joint configurations: distribution of the feature [stacked]**

In this section, asymmetry in the distribution of joint configuration is illustrated by analyzing the joint feature [stacked]. We first address its crosslinguistic distribution, and then we describe language-internal differences. In the [stacked] configuration, each successive selected finger of a handshape becomes increasingly flexed, beginning with the index finger (Johnson 1990). In other words, the fingers are progressively spread apart from each other in a plane perpendicular to the palm. In Figure 13.4, this feature is located at the joint node. Examples of “plain” and [stacked] handshapes are shown on the top of Figure 13.7. As with the 3FHSs, we first looked at the dictionaries and lexical databases to determine the distribution of the stacked configuration in the core and foreign components forms of each language. For classifier forms, we concentrated on data from two pictures from the Zwitserlood stimuli that we felt had the strongest chance of eliciting a stacked configuration due to the leg positions of the characters involved (bottom of Figure 13.7). Although the stacked feature is attested in four-fingered handshapes as well as in handshapes with the index and middle fingers selected, here, we limit our discussion to the two-finger cases (e.g.,  vs. ).

Unlike the 3FHSs, the stacked joint configuration in  was found in nearly all segments of the lexicon crosslinguistically, although the degree to which it was used varied depending on the language.⁷ Crosslinguistic distributional differences included

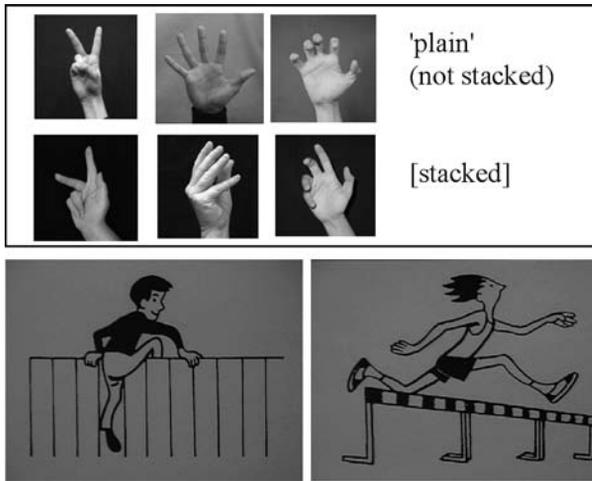


Figure 13.7 (top) Examples of plain and [stacked] handshapes. (bottom) Stimuli used to elicit [stacked] handshapes.

a lack of stacked handshapes in the foreign component of HKSL (likely due to the relatively small set of character signs available rather than a phonological constraint), and an apparent bias against (but not prohibition of) stacked handshapes in DSGS classifiers as compared to ASL and HKSL. The distributional analysis of [stacked] language internally is described in each of the following subsections.

4.1 ASL

The stacked configuration  is found in the foreign component of ASL in the fingerspelled letters K and P, as well as in initialized signs using those letters (e.g., KING, PRINCIPAL) and in variants of initialized V () signs in specific phonetic contexts (e.g., VERB). In the core component, [stacked] can be seen in signs such as BORROW, TWICE and SEE, as a variant of , again in specific contexts. The classifier data also yielded stacked handshapes: to represent the pictures in Figure 13.7, two of the three informants used the [stacked] configuration to represent both the boy climbing over the fence and the person hurdling. (The third informant used lexical items to portray each event.) We also observed that a [stacked] variant of a  semantic vehicle classifier can be used, when, for example, a bicycle is lying on its side, but not for a two-legged  body part classifier in the same orientation, when, for example, a sunbather is lying on her back. (See section 6 for further discussion of this point.)

4.2 DSGS

As in ASL, a  handshape is used to represent the letter K in DSGS, and consequently, it is seen in initialized signs with that letter (e.g., KIOSK, KLASSE). Examination of the video entries in the lexical database (Boyes Braem 2001a) suggests that in the core, a stacked variant is sometimes used in signs with  handshapes in certain orientations; however, its use seems to vary across signers. In the classifier data, the stacked configuration did occur but was rarely chosen (and was sometimes actively avoided) in the depiction of perpendicular leg positions; other strategies were utilized instead. In fact, of the three informants, no one used a stacked handshape spontaneously to represent the boy climbing over the fence – leg position was either not mentioned or a two-handed form (representing one leg per hand) was used – and only one informant used stacked fingers for the hurdler, the others using a two-handed form or a non-stacked handshape with both fingers “jumping” simultaneously. When asked, one of the informants who did not use a stacked handshape admitted that it was an acceptable variant, but then went on to say that she felt representing each leg on a separate hand was the better choice.

4.3 HKSL

In contrast to ASL and DSGS, there were several core lexical items using  in HKSL (e.g., BORROW, SILVER and EXPLOIT), none of which seemed restricted to particular phonological contexts. No stacked handshapes were found in known character signs, but that could be due to the small set of forms and does not necessarily mean that stacked forms are expressly prohibited in the foreign component.⁸ In the classifier data examined, all three informants used stacked handshapes spontaneously in their depictions of the two picture stimuli. In addition,  is the recognized semantic classifier used to represent bikes of all sorts in HKSL.

To summarize these two sections on selected fingers and joint distribution, we see that there are discernible differences both crosslinguistically and language-internally in the way that sub-lexical properties of handshapes are used. For 3FHSs our analysis shows that there are differences in the degree of acceptability across the three sign languages: 3FHSs are more acceptable in HKSL than in either DSGS or ASL, based both on the confidence and consistency of the informants and on the fact that there are core lexical items with 3FHSs in HKSL but not in the other two sign languages. Moreover, when 3FHSs were deemed acceptable in ASL and DSGS classifier handshapes, the 3FHSs were used only to alter morphologically the number of subparts belonging to the whole (e.g., three legs of a boy, three prongs of a tool, three claws of a bird's foot), while in HKSL they were used more

readily overall (i.e., to alter the number of parts or the thickness of an object). These crosslinguistic variations may be explained by a different ranking placed on such factors as ease of articulation, ease of perception or iconicity (see Eccarius 2008). Regarding the distribution of [stacked] joints, our data suggest that it is an acceptable configuration in all three languages to varying degrees.⁹ However, there are indications of differences in the way [stacked] is used in each component – an issue that will be discussed in more depth in section 6 in the context of the application of constraints. For the three sign languages studied here, our analysis suggests that DSGS is the language that uses these two marked properties of handshape the least, with a stronger preference for the two-finger variants over the 3FHS and reluctance to use [stacked] when another option is present, even in classifier constructions. Meanwhile, HKSL uses both of these properties much more readily, and ASL is somewhere in between the two.

5 Feature asymmetries across classifier types

Not only can the distribution and types of feature contrasts differ among the major lexical components, as illustrated above, but they can also vary across smaller segments of the lexicon. In this section, we suggest that there are asymmetries in the phonological behavior of handshape features across different classifier handshape types. In addition to the grammatical importance of the handshapes for syntax and morphology in classifiers, there is also a great deal of iconicity that is present in these forms, and this iconicity is present in the different types of classifiers to varying degrees. However, of all of the potentially iconic properties that classifiers contain, only a small subset of these is codified in a discrete way in the linguistic system (see Supalla 1982 and Eccarius 2008 for a discussion of the morphological status of handshape structures in different classifier types). Incorporating iconicity into the phonological grammar is an idea that has been argued for by others previously (e.g., van der Kooij 2002, van der Hulst & van der Kooij 2006). Brentari (in press) and Eccarius (2008) have also suggested that, rather than considering iconicity a factor that undermines the phonology of sign languages, it should be considered a unique and important element in shaping the phonology, along with the pressures of ease of articulation and ease of perception.

Here we provide a phonological analysis of four classifier types – semantic classifiers (SCLs), instrumental classifiers (ICLs), descriptive classifiers (DCLs) and handling classifiers (HCLs) – and the ways they use iconicity in a more in-depth way for the sign language we know best (ASL). The data described in the subsections below come from our ASL informants' descriptions of the Zwitserlood pictures and from the interviews eliciting grammaticality judgments about which

feature classes can be altered in members of these four classifier types. Examples of the classifier types discussed in the next sections are provided in Figure 13.8.

5.1 Semantic classifiers (SCLs)

SCL handshapes represent an object as a whole via their semantic class. Their representation tends to be more abstract than other classifier types, although remnants of iconic relationships can still be apparent in some forms (e.g.,  for an upright person, or  for an airplane). Within this classifier type, we have found quite a variety of possible selected finger combinations (especially considering SCLs constitute a very small number of forms), ranging from unmarked handshapes () to more marked ones (). The selected fingers themselves are not used morphologically, that is, they cannot be used to represent the specific size or shape of a specific object, but rather they are used phonologically as in core forms. In contrast, we find only a small number of joint configurations used in these forms, with the vast majority of classifiers having extended fingers. Selected fingers are utilized more in SCLs than in any other classifier type, and joint configurations the least.

5.2 Instrumental classifiers (ICLs)

ICLs are a mixed category of classifiers in many ways. Like SCLs, these handshapes represent whole objects, but they make use of more iconicity than do SCLs and can represent more physical attributes of the individual tool being used. Also like SCLs, ICLs have an asymmetry between the distribution of their joints and selected finger possibilities – we have found multiple selected finger combinations and very few joint configurations represented (see the ICL handshapes in Figure 13.8). However, the handshapes of these classifiers appear to be restricted to finger combinations including adjacent fingers. Selected fingers are used morphologically in ICLs since they can be altered (albeit with restrictions) to indicate changes in size and shape – e.g., , a thin paint brush vs. , a thicker paintbrush – or the number of component parts – e.g.,  a two-pronged garden tool vs.  a three-pronged garden tool. While selected fingers are utilized more than joints in ICLs, joints are also occasionally used in a restricted way. In some rare instances, while providing detailed descriptions of tools, informants were able to alter the joints morphologically (e.g., a fork mangled in a dishwasher), but most of the time when this type of alternation is possible, the handshape is a description and cannot be *used* as an instrument (e.g., the mangled fork handshape cannot be used to eat with, even if the

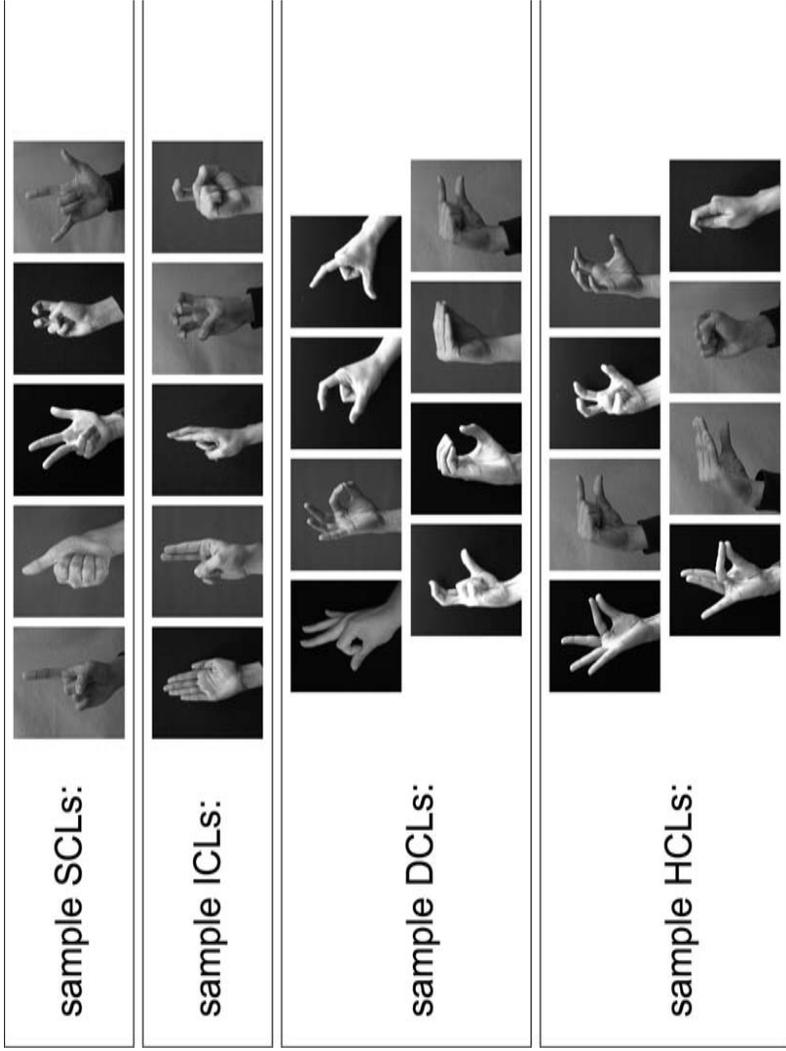


Figure 13.8 Examples of handshapes that function in the four types of classifiers in this analysis.

fork itself is still functional), suggesting that these classifiers behave more like DCLs in this case.

5.3 Descriptive classifiers (DCLs)

DCLs do not represent the whole object but instead represent the perimeter and the number of spatial dimensions of that object (2-D vs. 3-D) by altering the selected fingers and joints. The extent to which these features can be altered morphologically is as yet unclear. Emmorey and Herzig (2003) determined that joint alterations in this type of classifier handshape were categorical when produced by signers naïve to a specific range of sizes; e.g., using a generic ‘small round flat object’ classifier when referring to a shirt button without making a comparison to the full range of button sizes in existence. Perceptually, however, signers could be sensitive to gradient differences in handshape (e.g., someone describing a variety of buttons in a collection). Based on their results, they hypothesize that: “[W]ithin a contrast set, signers know that handshape size can be manipulated to indicate gradient variations in size. This gradient variation may be thought of as a gestural overlay on a morphemic representation. As noted, the analogy may be to English speakers using variations in vowel length to indicate gradations in duration or length” (Emmorey & Herzig 2003: 244).

This ability to use DCLs either gradiently or categorically makes determining specific contrasts challenging, to say the least. However, in our data thus far we have found examples of numerous potentially contrastive joint configurations.¹⁰ For example, Supalla (1982) and new perceptual evidence by Eccarius (2008) suggest that there are at least four contrastive joint configurations used in DCLs simply for representing round objects. The selected finger possibilities, on the other hand, are much more restricted, even given the few fingers available. In our data thus far we have observed only the use of the index finger, middle finger, index and middle fingers together, and all fingers (but not 3FHSs) as shown in Figure 13.8, with change in the quantity of selected fingers frequently indicating varying widths.¹¹ Like the ICLs, in DCL handshapes involving more than one finger, the fingers are adjacent to one another. We conclude, based on our data, that the joints are used more frequently for contrast than selected fingers in DCLs.

5.4 Handling classifiers

In contrast to DCLs, we consider HCLs to be a representation of the shape of the hand manipulating an object rather than the dimensions of the object itself. There is some research that indicates that HCLs, at least in terms of their handshapes, are

highly gestural in nature (e.g., Slobin *et al.* 2003). We agree that of all the classifier types, HCLs seem to be the closest to the gesture system, but we maintain that they are not completely void of linguistic systematicity. While HCLs represent the shape of the hand manipulating an object rather than the shape of the object itself, changes in the joints and/or selected fingers of a given HCL can result in a perceived change in an object's shape or size, although in this case it is by virtue of the way various objects are routinely held. For example, a flat, closed hand (☞) represents the handling of a thin, flat object like an envelope, while a flat-open hand (☞) represents how someone would hold a thicker, flat object like a book. There are numerous potential joint contrasts (including [stacked] joint configurations) based on differences in handling objects of various sizes, such as those shown in Figure 13.8, especially as compared to the small number of observed selected finger combinations. Changes in selected finger combinations (in conjunction with varying joints) indicate differently sized objects (e.g., light bulbs) by showing how each is manipulated. The same selected finger combinations are found in DCLs and HCLs. ASL does not permit HCLs with three fingers, despite the fact that such grips are used in the real world.¹² Hence, HCLs utilize joints more than any other type of classifier, and to a much greater degree than they utilize selected fingers.

In summary, the four types of classifiers discussed in this section vary in the distribution of joint and selected finger contrasts as well as in the type of contrasts possible, constituting a continuum ranging from the more core-like SCLs to the more gesture-like HCLs (see Figure 13.9). As you move away from the SCLs on this

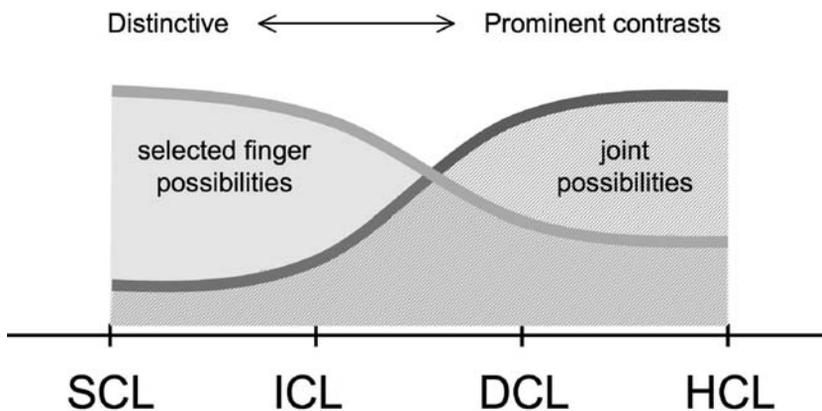


Figure 13.9 Continuum of joint and selected finger possibilities for the four types of classifier handshapes analyzed.

continuum, the relative number of selected finger contrasts found in each subtype decreases, while the number of joint contrasts increases. SCLs behave like lexical items in the core because handshape properties are used phonologically, while in other classifier types these properties are used morphologically.

6 Theoretical implications

In this section, we will first address how the differences described in sections 3 to 5 can be captured in a phonological system using new work on *phonological contrast*. These examples are not simply the familiar phenomena of minimal pairs and phonological rules that hold for core lexical items, yet we are claiming that they are important and useful facts about the phonological grammar of sign languages. Second, we will describe what is gained by knowing about these differences in terms of new insights and generalizations.

6.1 Theories of phonological contrast and their application to sign languages

Every theory of phonological representation has had to deal with the concept of phonological contrast, including the Prague School (e.g., Trubetzkoy 1939), Structuralism (e.g., Bloomfield 1933, Harris 1951), distinctive feature theories (e.g., Jakobson, Fant & Halle 1951), early generative phonology (Chomsky & Halle 1968) and Underspecification Theory (Archangeli 1988a, 1988b; Steriade 1995). Focusing on more recent work regarding contrast (Avery & Idsardi 2001, Clements 2001, Dresher 2003), we argue that the *types of contrast* in (2) and the *distributional patterns of contrast* in (3) (discussed in section 6.2) come together to explain some aspects of sign language phonology that heretofore have been left unaccounted for.

First, in order to appear in a phonological representation, a feature or structure must be *contrastive*, but this means much more than simply participating in a minimal pair. There are different types of contrast in a phonological system. The criteria developed in the Prosodic model (Brentari 1998) for including a phonological structure or a feature in the hierarchy were: (1) use in a minimal pair (or in the absence of a minimal pair, if a change in feature value results in an ungrammatical form), (2) use in a phonological constraint or (3) use morphologically in a productive way. These criteria are quite similar to the criteria set forth for spoken languages in Clements (2001), who uses the terms “distinctive,” “active” and “prominent,” described in (2). These are not mutually exclusive categories, as a feature can participate in more than one.

- (2) Phonological contrast types
- a. Distinctive: The presence/absence of this type of feature in a pair of segments creates a minimal pair. E.g., [voice] in English obstruents in a pair, such as ‘[z]oo’/‘[S]ue.’
 - b. Active: This type of feature is used in a phonological constraint. E.g., [voice] in German obstruents in word-final position, in a case such as ‘ra/d/’ > ‘ra[t]’, (Eng: ‘advice’). A constraint prohibits voiced obstruents in codas: *CODA_[+ voice].
 - c. Prominent (a subtype of active): This type of feature qualifies as an autosegmental tier because it is: (a) involved in a particular type of phonological operation (such as spreading), (b) used productively for morphological purposes, (c) a participant in long-distance effects, where a segment affects a non-contiguous segment, or (d) involved in many-to-one association.¹³ E.g., [high] in Japanese palatalization used to mean ‘unreliable’ (Hamano 1998), as in cases of awkward or irregular movement, such as ‘p’oko-p’oko’ (Jap: ‘jumping around in an uncontrolled manner’) from ‘poko-poko’ (Jap: ‘up and down movement’).

In Clements’s (2001) terminology, features are “distinctive” when the presence of that feature results in a minimal pair (a lexical distinction, not one where the two forms are morphologically related), “active” when involved in a phonological operation and “prominent” (a subtype of active) when used to establish an autosegmental tier (Goldsmith 1976). Active features have always been a part of the representation at some level,¹⁴ but prominent features have not played a large role in discussions of distribution types in spoken language phonology, since often these are considered “not purely phonological.” Clements’s approach brings them back under the phonological umbrella. Crucially this approach allows all three types of features or feature structures to be in the phonological representation rather than allowing only distinctive features in the representation.

6.1.1 3FHSs

What our data in sections 3 to 4 show is that 3FHSs are “distinctive” either in the foreign component alone (in ASL and DSGS) or in both the core and the foreign components (in HKSL). They are “prominent” in classifier forms, and since they participate in historical change, they can also be “active.” For example, some contrasts involving 3FHSs seem to be disappearing over time, as they move from the foreign to the core component. For instance, the ASL signs DOCTOR and THOUSAND were originally borrowed from the initialized LSF signs MÉDECIN

and MILLE using M-handshapes () , but there seems to be a diachronic move toward use of a four-finger handshape instead as these signs lose their foreign status. Similarly, in HKSL, the dictionary lists three- and two-fingered variants for one instance of a borrowed sign ( vs.  in BOYSCOUT, originally from a hearing gesture), perhaps indicating that, although allowable in the core, in some cases 3FHSs are still less desirable than other alternatives.¹⁵

6.1.2 *Stacked handshapes*

The data show that [stacked] handshapes are distinctive in the foreign components of ASL and DSGS, and in the core component of HKSL. [Stacked] participates in a synchronic phonological operation as well, so it is also *active* (at the very least, in ASL). For two-finger forms, the relevant contexts for an unstacked handshape to become [stacked] are: (1) when the palms face inward toward the midline, as in the ASL core signs BORROW, FIGURE-OUT and CARE; (2) when the middle finger makes contact with another part of the body, as in the ASL core forms SEE and TWICE and the initialized sign VERB; and (3) when an underlying palm-up orientation and/or wrist rotation to a palm-up orientation occurs, as seen in the final position of the sign FALL or the classifier construction ‘vehicle-turned-on-its side.’¹⁶ This active use of the [stacked] feature is available in all of the ASL lexical components, but it is blocked in situations where the [stacked] feature is prominent. For example, in the palm-up classifier handshape used to represent a sunbathing person lying on his/her back, a stacked configuration would be rejected unless it matched the leg position of the sunbather.

6.1.3 *Classifiers*

This approach also allows us to see more clearly the differences among classifier types – phonologically in ASL (and likely crosslinguistically), classifier handshapes do not form a homogeneous class with respect to contrast type. In SCLs (despite historical iconic links between handshape and meaning), when the fingers or joints are altered in some way, it creates either an ungrammatical form or a completely new one; hence, according to our definitions of contrast, these elements are distinctive.¹⁷ For example, if you increase the number of selected fingers (not counting the thumb) in a ‘vehicle’ classifier from two () to four () , the resulting handshape cannot be used to represent a larger car; the change is ungrammatical in this context, the relative size instead being shown by in the signer’s facial expression (e.g., ‘puffed cheeks’ indicate a large truck driving past). Furthermore, changing which two fingers are selected – e.g., the index and middle fingers for a ‘vehicle’ classifier (, e.g., car) to the index and pinkie () – results in a different SCL (in this case, ‘airplane’). Further evidence for the distinctive use of features in SCLs

comes from a fact mentioned in section 4.1; namely, the active use of [stacked] is possible in the ASL SCL ‘vehicle lying on its side,’ but not in the body part classifier ‘sunbather lying on her back.’ We would argue that this is because the feature specifications of the base handshape are distinctive in the SCL but prominent in the body part classifier. In ICLs, selected fingers and joints are also distinctive to some extent, since a change in feature often results in a different tool (e.g., ‘toothbrush’ must have one selected finger to be grammatical; and curved fingers in ‘spoon’ contrasts with extended in ‘knife’). However, as mentioned earlier, ICLs are a mixed class, as evidenced by some instances where selected fingers can be used prominently to indicate varying dimensions of the same tool (e.g., widths of ‘paintbrush’ using two or four fingers). Finally, both feature types are used prominently in DCLs and HCLs to indicate differences in size and shape (e.g., varying thickness via different selected finger combinations and round vs. flat objects via joint configurations). Therefore, we see that SCLs with their distinctive feature contrasts are phonologically more similar to core items with regard to contrast type than the other classifier types which can use features prominently to varying degrees.

In summary, in making this move to allow features of all contrast types in the representation of sign languages, several insights can be made. First, contrast types and lexical affiliation are closely linked. This is true not just in ASL, but crosslinguistically for the three sign languages studied. The work in sections 3 to 4 shows that prominent contrasts are present in classifier constructions, distinctive contrasts appear primarily in the core and foreign components, and active contrasts are possible throughout the system. This pattern is quite strong, even if there are notable crosslinguistic differences in terms of degree of acceptability as we have shown. Furthermore, without a category of prominent features, the generalizations about selected fingers being associated with semantic and instrumental classifiers and joints associated with descriptive and handling classifiers would be missed, since prominent features had previously been relegated to the margins of phonology. These divisions of labor of features and their contrastive types in sign languages can be seen as potentially universal for this language family and are elements that can be followed closely in emerging sign languages and homesign systems as they change over time.

Second, we see more clearly that the elements of a handshape’s phonological representation function very differently across the different components of the lexicon and among classifier types. Referring back to Figure 13.4 we see that, following Brentari (2005), the “handshape” node is phonological in core forms, but in both foreign and classifier forms this same node plays a morphological role. In foreign forms and in semantic classifiers, the handshape node itself is the site of

the morphological affix; while in other classifier forms, nodes lower in the tree such as joints and quantity (under selected fingers) may be morphological.

Finally, the approach taken here also helps to explain why there are so many differences among the phonological models of sign language. The reason why some models have more features and even more types of features is, in large part, due to the lexical components from which the researchers draw their data. To take a few examples, models such as Sandler (1989), van der Hulst (1993, 1995) or Channon (2002a), have focused primarily on what is needed to capture the core lexicon, considering primarily those features that are distinctive, while others such as Liddell and Johnson (1989) and Brentari (1998) have sought to capture the spatial and foreign components as well. This is true for the handshape elements discussed in this chapter, for handshape in general, as well as for the larger representation, which includes movement and location features. One direction for future work in sign language phonology would be to take into account the type of data presented in this chapter to create representations that more transparently reflect the asymmetries among the lexical components.

6.2 Types of phonological distribution

In addition to recognizing different contrast types, we also recognize different kinds of distributions in our analysis. Goldsmith (1995) describes five distributional patterns of contrast that can hold between a feature and a phonological system; these are shown in (3). Like the constraint types, these are not mutually exclusive categories, and features can participate in more than one of these distributions within a given language.

- (3) Distributions of spoken language features within a phonological system
- a. Allophonic: completely determined by the system (e.g., [aspiration] in English)
 - b. Barely contrastive: almost completely determined by the system (e.g., [retroflex] in English)
 - c. Not yet integrated semi-contrasts: a general move has taken place in the system but a few remnants remain (e.g., [tense]/[lax] in Florentine Italian mid-vowels)
 - d. Modest asymmetry case: the alternation is allophonic in one part of the lexicon, but distinctive in another (e.g., [\pm labial] in the Japanese periphery)
 - e. Distinctive contrast: the opposition creates a minimal pair (e.g., [voice] in English)¹⁸

Typically (3a) and (3e) are the efficient workers in the phonological workplace (albeit in different ways), and most work on spoken language phonology has focused on them. In allophonic cases, (3a), it is the *rule system* that is working; a feature such as aspiration in English is typically not in the lexicon. Instead, there is a rule that selects a set of well-defined forms to which the feature is added. This is exactly what happens in the case of aspiration in English – /p, t, k/ > [p^h, t^h, k^h] at the beginning of words when followed by a vowel. In distinctive contrast cases, (3e), it is the *representation system* that is working; a feature such as [voice] in English is always in the lexicon. For example, the voiceless obstruents /p, t, k/ are distinct from the voiced ones /b, d, g/ because the feature [voice] is in the representation in the latter forms.

Cases (3b)–(3d) are the in-between cases. Barely contrastive cases, (3b), are determined largely by rule, but not completely; in the case of English [–retroflex], a redundancy rule makes all sounds [–retroflex], except for /r/ which needs [+retroflex] to distinguish it from /l/. In the not yet integrated semi-contrasts, (3c), the feature in question is largely allophonic, but a small pocket of forms with contrast remains. For example, all vowels are redundantly [tense] in Italian except in Florentine Italian which holds onto a mid-vowel contrast /e/-/ɛ/ and /o/-/ɔ/. Modest asymmetry cases, (3d), are determined largely by representation, but there is a sizable set of forms that is handled by a rule, such as the Japanese /h/-/f/ case we saw at the beginning of the chapter. The Italian and Japanese examples in (3c) and (3d), respectively, are particularly important because they show that variable behavior in the phonological system may be due to having multiple components of the lexicon – in the Florentine Italian case the distribution is due to an historical remnant of Late Latin (Marotta 1985, van der Leer 2006), and in the Japanese case it is due to recent foreign borrowings into the language.¹⁹

For sign languages thus far we have focused on the specific, marked 3FHSs and [stacked] forms as a pair of case studies, but let us now widen the discussion to include selected fingers and joints, more generally. Using the categories of distribution for spoken languages described in (3), examples of the distribution of selected fingers and joints structures of handshape are given in (4).

- (4) Distributions of handshape elements
 - a. Allophonic: determined completely by the system.
 - i. Selected fingers: We found no examples of this.
 - ii. Joints: e.g., [flexed] in the context of handshape change; the value of one handshape is predictable from the value of the lexically specified handshape.

- b. Barely contrastive: almost completely determined by the system.
 - i. Unselected fingers:²⁰ These are largely predictable from aperture value of the selected fingers, but there are a few cases where unselected fingers in index finger handshapes are contrastive. (ASL near minimal pair PERFECT () vs. REVENGE, ()).
 - ii. Joints: flexion of the metacarpal (knuckle) joint is largely predictable (Crasborn 2001), but there are a few cases in B-handshape forms where the metacarpal joint must be bent, such as ASL SUN ().
- c. Not yet integrated semi-contrasts: a general move has taken place in the system, but a few remnants remain. We found no examples of this.
- d. Modest asymmetry case: the alternation is allophonic in one part of the lexicon, but distinctive in another. (Numerous examples)
 - i. Selected fingers: 3FHSs (i.e., the historical changes from LSF to ASL in the 'M' to 'B' in DOCTOR).
 - ii. Joints: [stacked] handshapes.
- e. Distinctive contrast: the opposition creates a minimal pair.
 - i. Selected fingers: one- vs. two-finger handshapes in ASL APPLE () vs. NERVE ().
 - ii. Joints: the feature [spread] in the SCREWDRIVER () vs. MEANING ().

First of all, as (4d) shows, both of our specific examples – 3FHSs and [stacked] – are like the modest asymmetry cases of (3d). They are neither allophonic or distinctive everywhere, so they do not match the criterion of (3a) or (3e). Their contrasts are more widespread than a feature such as [retroflex] in English, so (3b) is also eliminated. We are left with (3c) and (3d). (3c) cases are in the process of being incorporated into the grammar. Notice that our specific examples of 3FHSs and the feature [stacked] fall best into the (3d) “modesty asymmetry” group because there are clear asymmetries in contrast type based on lexical affiliation.

More generally, while the examples in (4) show that selected fingers and joints have distinctive contrasts throughout the core and foreign components, phonologists working on sign languages know that minimal pairs are scarce; work by Liddell and Johnson (1989), Sandler (1989) and Brentari (1998) demonstrates clearly that distinctive contrasts exist, but there are far fewer minimal pairs in signed languages than in spoken languages. This is also true for operations that are purely allophonic.

In ASL both selected fingers and joints participate in phonological processes such as handshape assimilation in compounds in ASL (Liddell & Johnson 1986, Sandler 1989), but almost all rules/constraints are optional. To our knowledge the example of handshape change is the only example of purely allophonic alternation. Comparing the spoken language examples like those in (3) with sign language examples such as in (4), the number of cases in spoken languages in categories (3a) and (3e) is very high, and as Goldsmith (1995) notes, these have received the lion's share of attention in the spoken language literature. In sign languages, however, fewer cases exist at these extreme ends, and more cases are mixed cases (3b–3d).

We would argue that the explanation for differences between signed and spoken languages in the number of cases per distribution type is twofold. First, *articulator independence* and *iconicity* conspire to realize a different distribution of phonological elements in signed vs. spoken languages. Regarding (4e) we would argue that the small number of minimal pairs in the core lexicon is due to iconicity in movement and location because this iconicity creates a sparsely populated grid of lexical items (van der Hulst & van der Kooij 2006).²¹ On the other end of the spectrum, purely allophonic distribution, we would argue that the small number of examples is due to the greater articulatory independence in sign languages with respect to spoken languages. In spoken languages, because of the confined space and the limited number of articulators in the vocal tract, most movements of one part of the tongue – e.g., the tongue tip – effect movements of other parts of the tongue as well as the length of the vocal tract. In the absence of antagonist moves to the contrary, phonological “gestures” in speech have a constellation of concomitant, phonetically motivated and potentially allophonic consequences. Some such phonetic consequences exist in sign languages, too, but in general, articulation is slower in sign language, and the articulators of the body, arms and hands in sign languages are capable of greater articulatory independence than spoken language articulators.²² Since sign languages are freer to control the movements of the hands and body, phonological elements have fewer allophonic consequences dictated by the entire articulatory system.

This section demonstrates there are surprising consequences of modality on the distribution of feature elements for both signed and spoken languages that only come to light by juxtaposing the two types of languages and their distribution types side by side. Sign languages are excellent language cases for studying both the effects of contrast types throughout a system and how the system is changing in historical time, precisely because they have a wide range of synchronic lexical origins and evidence of historical change as well.

7 Conclusions

This chapter has attempted to provide a glimpse into the crosslinguistic and language-internal variation that exists in handshape. To undertake this type of study, corpora of considerable size must be employed in several languages, and in making a list of handshapes and handshape contrasts, all types of contrast must be considered – distinctive, prominent and active – as well as the lexical affiliation of the forms examined.

In sections 3 to 4, crosslinguistic and language-internal differences were described for two rare properties of handshape – 3FHSs and [stacked]. From our analysis, HKSL emerged as the language that accepted and used these marked properties the most, DSGS the least, and ASL was between them. We also determined that in terms of function and distribution, there was a similar pattern across the three languages. The spatial component used these features prominently (with the exception of semantic classifiers), the foreign and core components used them distinctively, and the entire lexicon has the potential to use them actively. In section 5, based on ASL data, we see the relationship among iconicity, morphology and phonology more clearly; that is, certain types of iconicity are abstract in the classifier system (as in SCLs) and not all iconic properties are used by the morphophonology equally in the different types of classifier handshapes.

In section 6, the theoretical implications of this work were explored. We argued that without a model that recognizes different types of contrast, several generalizations would be overlooked. First, without a comparison between distinctive, active and prominent contrasts, we would miss the different distribution of these contrasts in foreign and core forms across languages. Second, we would overlook the fact that SCLs are the classifier type most similar to core lexical items, because the distinction between prominent and distinctive contrasts would not be evident. Third, we would not recognize the iconic and morphophonological use and distribution of selected fingers and joints in the different types of classifier handshapes (at least for ASL), because prominent features are not typically considered in phonological analyses, making such comparisons impossible. By using Clements's three types of contrast, considered to be at equal levels of importance, we can begin to sharpen our gaze at exactly how morphology (and iconicity) interact in the phonology.

We also discussed how obscuring the differences between lexical components can make the phonological models of sign languages look more different than they actually are with regard to the number of features. This calls for a new type of approach to representation that accounts for differences among lexical components and across languages, while also providing an analysis of the use of contrast

and iconicity for different classifier handshapes. This is a question for future research, but our work suggests that a set of ranked constraints using Optimality Theory may work well to represent FAITHFULNESS OR MARKEDNESS constraints operating in perception, production and iconicity to different degrees (see Eccarius 2008).

In doing this work, we hope to encourage other researchers to include in their inventories not only handshapes whose features can be supported by a minimal pair (distinctively), but also those that are used morphologically (prominently), as well as those used in phonological operations (actively). In doing so, a more accurate tally of handshapes and their uses crosslinguistically can be made.